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Total Knee Arthroplasty and the Unforeseen Impact on Return to Work: A Cross-Sectional Multicenter Survey

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ABSTRACT

The number of patients receiving a TKA during working life is increasing but little is known about the impact of TKA on patients' reintegration into the workplace. In this cross-sectional survey it was found that 173 of 480 responders worked within 2 years prior to surgery. Sixty-three percent of the working patients stopped within two weeks prior to surgery and 102 patients returned within 6 months. One third never returned to work. Activities that most improved were operating foot pedals, operating vehicles, standing and walking on level terrain. Activities that least improved were kneeling, crouching and clambering. Fifty patients scored 5 or less on the Work Ability Index. Thirty patients were dissatisfied. TKA significantly, but unequally, reduces difficulties in carrying out knee-burdening work activities.

Total Knee Arthroplasty (TKA) is highly effective in treating pain caused by rheumatoid arthritis or osteoarthritis of the knee [1]. However, little is known about the impact of TKA on patients' reintegration into the workplace [2,3]. Recently it was found that the combined loss of productivity plus medical costs for conservatively treated symptomatic knee osteoarthritis for those in paid employment in the Netherlands amounts to €871 per patient per month, with loss of productivity accounting for 83% and medical costs for 17% [4].

The impact of this problem on societies is substantial. In the USA, 650,000 TKAs were performed in 2008 and 77,500 in the UK in 2009 [1]. The absolute number of primary TKA being performed is increasing and expected to rise exponentially [1,5]. Currently about 20,000 TKAs are performed in the Netherlands each year but it is estimated that this number will rise to 60,000 a year in 2030 [6]. Historically, TKA has mostly been performed in older retired patients. Recent studies, however, have shown that since 1996 the number of patients aged 45–65 years who have undergone TKA has tripled [7]. In the United States nearly 1.5 million people of those with a primary TKA are fifty to sixty-nine years old [8]. People nowadays have higher expectations with respect to physical mobility as they age. Moreover, certain lifestyles are leading to an increase in younger patients needing TKA. In addition, the increase of obesity in middle-aged people in the western world, an important risk factor for developing osteoarthritis, will further add to this [9]. Because TKA is now performed on younger people while, at the same time, the age for retirement is expected to rise in the Netherlands and other western countries, patients are more likely to be of working age at the time of surgery.

Most studies on TKA examine surgical measures such as clinical outcome and survival while taking surgical revision as the endpoint. Patient reported outcome measures (PROMs) are becoming more important because these position the patient at the center of an evaluation of surgical treatment. TKA has proven to be highly effective in reducing pain and increasing quality of life. Studies showed that, only 8% of 25,275 patients were dissatisfied regarding their TKA at 2–17 years postoperatively [10]. It was, therefore, expected to be effective in ensuring a timely and sustainable return to work in patients and so reducing loss of productivity for society. For patients, active work participation is an important factor in enhancing quality of life. Patients feel useful to society. It gives structure to day-to-day life [11]. Until now, only a few studies have reported how long it takes for patients to return to work after TKA and then mostly by secondary outcome measures [12–20].

Improved decision making about whether and when it is indicated that a patient should undergo a TKA procedure is needed [1]. If there is more detailed knowledge about the impact of TKA on

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work, patients and doctors can make more informed decisions about whether TKA is the appropriate treatment to increase the ability to participate at work. More knowledge will also provide a basis to test the potential positive impact of interventions on the return to work.

The questions addressed in this study are, therefore: [1] when do patients stop work because of knee complaints and when do they return to work (RTW) after Total Knee Arthroplasty (TKA)?; [2] are specific knee-burdening work activities improved by surgery?; [3] what do patients report with respect to physical ability and satisfaction after TKA?

Materials and Methods

A multicenter cross-sectional study was performed on data from two centers, the Academic Medical Center (AMC) in Amsterdam and the Amphia hospital in Breda. The Medical Ethics Review Committee of the AMC deemed that the Medical Research Involving Human Subjects Act (WMO) does not apply to the study and official approval was not required.

Patient population

All patients from 2005 on who received a primary Vanguard TKA (Biomet Inc., Warsaw, Indiana, USA) and had a follow-up of at least two years were approached. Surgical details were noted as well as the follow-up period, age at operation, the presence of rheumatoid arthritis or osteoarthritis, ASA classification, diabetes, smoking status, body mass index (BMI) and admittance period.

All patients who were still alive at follow-up were sent an invitation with a reply form to participate either via a web-based questionnaire or a paper-based questionnaire. They could also respond by replying they did not want to participate. Non-responders were contacted by phone at least twice after the first invitation. If no contact was established, the remaining non-responders were sent a paper questionnaire once more.

A link to a digital questionnaire was sent to the e-mail address supplied by the patient. Patients were given a personal code to ensure anonymity of their Internet questionnaires. The use of this code meant that no medical information could be traced back to the patient without the code file that was stored on a secure in-house server at the AMC hospital.

Paper-based questionnaires were sent to the patients' home address. After completing the questionnaires, patients were asked to return them in the stamped addressed envelope provided.

Impact on Work

An 'impact on work' questionnaire named Work, Osteoarthritis or joint-Replacement Questionnaire (WORQ) was developed containing questions about patients' experiences in both paid and voluntary work. In the previous article [21], on the development of the WORQ score the reliability, validity and other measurement properties of the questionnaire are studied and reported.

Only patients who had had been in work within the 2 years prior to surgery were asked to fill out the full questionnaire. The survey contained three sections. The first section contained questions on the type of job, the time when patients stopped working pre-operatively, the time when patients returned to work post-operatively, changes in physically demanding tasks following surgery (less, the same or more), changes in working hours (less, the same or more), the type of job 2 years after surgery and, if patients stopped working, what the reason was for stopping (for instance retirement, knee complaints, other health complaints).

If job titles were reported in enough detail, they were categorized independently by two occupational health experts into light work, medium work or heavy work regarding knee-demanding activities. Both experts are experienced in performing systematic real time task analyses on the worksite to assess the physical work demands of occupations. The expert classification into light, medium and heavy work was performed using the evidence based exposure criteria for work-relatedness of knee disorders of the Netherlands Center for Occupational Diseases [22]. If disagreement existed this was resolved by discussion.

The second section of the questionnaire contained questions to assess difficulty with knee-burdening activities at work at three points in time: (T0) before the knee problems arose, (T1) within three months before TKA and (T2) at two years after TKA. The WORQ score resulting from a sum of these difficulties ranges from 0 (worst score) to 100 (the best score, no difficulties at all) and showed the impact of TKA on knee-burdening activities in patients who did return to work. This score is validated in a previous report on the WORQ.

The third section of the questionnaire contained the single item: 'current physical work ability' from the Work Ability Index (WAI [23,24]) on a scale from 0 'completely unable to work' to 10 'work ability normal'. Patients were also presented with the statement – I am satisfied with my ability to work with respect to my TKA – and were asked to choose the following answers: strongly disagree, disagree, neither agree nor disagree, agree, strongly agree. The answer was scored respectively 0 to 4 on a Likert scale.

Statistical analysis

Standard descriptive statistics were used to describe demographic data and baseline characteristics. For normally distributed variables, unpaired t-tests were used. Mann–Whitney tests were used for continuous non-normally distributed variables and chi-square tests for dichotomous variables to test for differences between working and non-working TKA patients at baseline. The effectiveness of TKA in reducing patients' difficulty performing specific knee-burdening activities was evaluated. The results are given in percentage of score improvement between three months before the TKA (T1) and two years after TKA (T2) and sorted from most improvement to least. The difference in scores between T1 and T2 was tested non-parametrically with paired testing. All analyses were done using SPSS 20.0 statistics software (IBM, Armonk, New York, USA). A P value < 0.05 was considered statistically significant.

Results

A preliminary review of all TKA patients from both hospitals resulted in 807 suitable to approach. The 764 patients who were still alive received an invitation to participate to which 558 (73%) responded (Fig. 1). Seventy-eight patients declined and 480 filled out a questionnaire. The questionnaires revealed that 173 were in work within two years prior to surgery. From the 137 interpretable job types, 48% performed light work, 32% performed medium work and 20% performed heavy work regarding knee-burdening activities in their previous work life. The average age of patients included in the study group was 60 (SD 9) with a gender distribution that was fifty-fifty (Table 1).

Stopping and returning to work

Of the 173 patients who worked in the 2 years before TKA, 29 patients stopped at least 6 months prior to the operation and this rose to 40 at three months prior to the operation. After surgery 117 (68%) patients returned to work of which 59 had returned to work within three months after TKA and by six months this rose to 102. After surgery 49 patients never returned to work (Figs. 2 and 3). There was

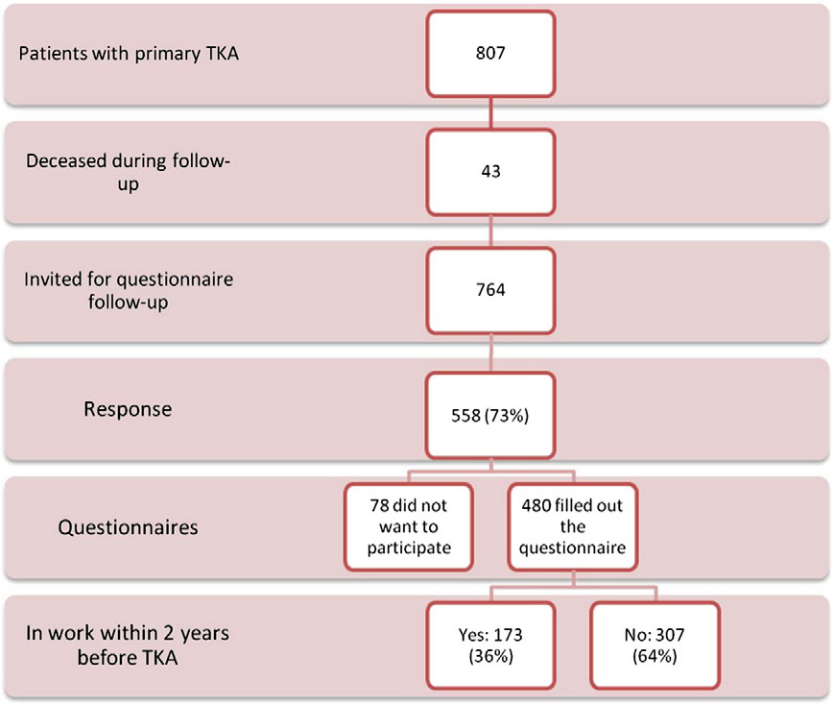

Fig. 1. Flow chart of inclusion of patient group.

no significant correlation between the physical demands of jobs and the timing of stopping or returning to work.

Changes in physical burden at work

Of the 117 patients that returned to work, 19 had a less physically demanding job, 78 had an equally physically demanding job and nine had a more physically demanding job after TKA as compared to before TKA (11 patients had unclear or missing answers). In addition, nine of the patients worked fewer hours, 94 worked the same amount of hours and five worked more hours after TKA (nine patients had unclear or missing answers).

At the time of filling in the questionnaire, at a mean of 3.8 (SD 1.3) years after surgery, 70 patients were still working, 89 patients no longer worked of which 11 patients blamed their TKA, 49 patients had retired, 17 blamed other physical complaints and 12 reported other reasons. Fourteen patients left this question unanswered. Most patients that still worked had the same job but eight patients worked in a different type of job.

The mean difficulty score per activity (Fig. 4) shows the impact of the arthritic knee or the knee after TKA on the difficulty experienced performing knee-burdening activities. Overall, at 2 years after surgery, patients experienced significantly less difficulty performing such activities compared to the 3 months prior to surgery ($P =< .005$). Activities that improved most after TKA were operating foot pedals (53% score improvement), operating a vehicle (48%) and walking on level terrain (48%). Activities that least improved by TKA were kneeling (19% score improvement), crouching (22%) and clambering (30%). Further details of sum scores for specific subgroups of patients are shown in the casemix table (Table 2).

Table 1
Baseline Characteristics of All Patients Who Worked as Well as Patients Who Did Not Work Within 2 Years Prior to Surgery.

		All n=480	Work n=173 (36%)	No Work n=307 (64%)	*P* Value
Age (years) mean (SD)		66.0 (9.7)	60.1 (8.6)	69.3 (8.6)	.000 a
BMI (kg/m^2) mean (SD)		29.4 (4.6)	29.5(4.7)	29.3 (4.5)	.730 a
Follow-up mean (SD)		3.8 (1.2)	3.8 (1.3)	3.7 (1.2)	.297 a
Hospitalization period in days median (range)		6 (2–38)	5 (3–30)	6 (2–38)	.094 b
		N (%)	N (%)	N (%)	
Gender	Male	179 (37.3)	85 (49.1)	94 (30.6)	
	Female	301 (63.7)	88 (50.9)	213 (69.4)	.000 c
ASA	1 or 2	374 (80.3)	148 (87.1)	226 (76.4)	
	3 or 4	92 (19.7)	22 (12.9)	70 (23.6)	.005 c
Smoking at operation	No	411 (85.6)	142 (82.1)	269 (87.6)	
	Yes	69 (14.4)	31 (17.9)	38 (12.4)	.105 c
Diabetes at operation	No	423 (88.1)	160 (92.5)	263 (85.7)	
	Yes	57 (11.9)	13 (7.5)	44 (14.3)	.028 c
Rheumatoid arthritis at operation	No	457 (95.2)	170 (98.3)	287 (93.5)	
	Yes	23 (4.8)	3 (1.7)	30 (6.5)	.024 c

T-test, b. Mann–Whitney, c. Chi-square

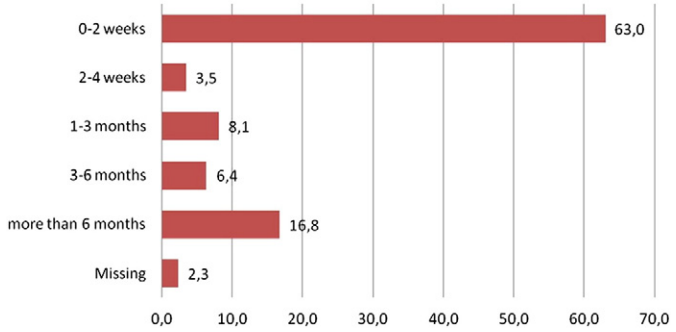

Fig. 2. Time when patients stopped work before total knee arthroplasty in % (N=173).

Patients' opinion about their physical ability to work

After surgery, 50 patients scored a 5 or lower on the WAI to describe their physical work ability. The mean score was 6.2 (95% CI 5.8 to 6.7). To the statement "I am satisfied with my ability to work with respect to my TKA", 30 patients answered that they either disagreed or strongly disagreed which meant they were (strongly) dissatisfied.

Discussion

The most important outcome of this study is that of the patients who were in work before TKA surgery, only 68% returned to work after TKA and of the patients not returning to work 11 reported that this was because of their TKA. In addition, 50 of 173 TKA patients gave a score of 5 or lower for their ability to work and 30 (17%) were (strongly) dissatisfied with their ability to work because of their TKA. The satisfaction for working patients is twice as low as expected based on previously reported 8% dissatisfied patients following TKA [10].

A literature search was performed to find what other studies reported about 'return to work' after TKA. The search terms 'Return to work AND "Arthroplasty"[Mesh]' were used and this yielded 68 studies. Nine studies were eventually found that specifically reported on 'return to work' after TKA [12–20]. The information was mostly limited to the percentage of patients who returned to work and at what point in time. On average, 70% of patients returned to work at some point during follow-up (Table 3). Our present study showed a similar percentage. Both hospitals in our study are large regional expertise centers that generally have a mixed patient population with normal patients as well as some patients requiring additional expertise due to less common comorbidities like gross deformities,

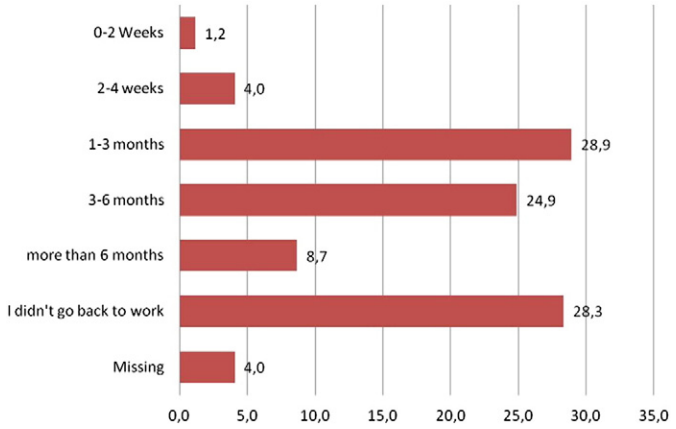

Fig. 3. Time when patients resumed work after total knee arthroplasty in % (N=173).

Fig. 4. Mean difficulty scores for specific knee-burdening activities at 3 intervals: T0 (before the knee problems arose); T1 (within three months before TKA); and T2 (at two years after TKA). Scale 0–100 with 95% CI, for T0, T1 and T2 — dimmed bars: purple bar % score core improvement between T0 and T2.

hemophilia, sickle-cells disease or a post-kidney transplantation condition. If the other studies included less specialized hospitals this could entail a more healthy patient population with a better prognosis for return to work.

None of the studies we looked at described the impact of TKA on specific knee-burdening activities, so our results could not be compared to other studies. The impact of TKA on the difficulty patients experienced performing knee-burdensome activities, was clear and we found that surgery resulted in patients' scoring a level comparable to the period before their knee complaints started. TKA can, therefore, be considered to contribute to increasing the ability to work. However, even though patients reported reduced difficulty in performing all activities, the improvement was not equally great for every activity. Patients with work that requires a lot of kneeling, crouching and clambering benefit less from TKA. Our results imply that patients whose work requires bending or kneeling on the ground, for instance plumbers, floor layers and gardeners, should be warned that TKA may relieve the pain but only marginally improve difficulty in performing these tasks. This might be because a TKA has a limited range of movement (ROM) compared to a normal knee. High flex knee TKA designs might be considered in these patients although they have not yet proven to add much more flexion until now [25]. In our previous report on the questionnaire a clinically significant improvement was an improvement of at least 13 points on the WORQ questionnaire. It is interesting to note that it seems that patients that returned to work with age above 65, diabetes, obesity, ASA 3 or 4 or rheumatoid arthritis seems not to have a

Table 2
Casemix Table Showing WORQ Scores for Different Subgroups of Patients at Three Months Prior to Surgery and 2 Years After Surgery.

	Mean Scores (95% Confidence Interval) for:	Before Operation	N=	Missing Scores	2 Years Post-Op	N=	Missing Scores
Gender	Male	54 (49–58)	82	0	69 (64–75)	63	4
	Female	55 (50–60)	85	2	69 (63–75)	58	3
Age	<55	48 (38–57)	26	0	68 (56–80)	21	0
	55–65	51 (46–56)	75	2	70 (66–74)	59	3
	65–75	62 (56–68)	54	0	73 (66–81)[a]	34	3
	>75	52 (41–62)	12	0	45 (24–65)[a]	7	1
Work Ability Index score	Above 6	55 (51–59)	103	1	74 (70–78)	87	2
	Below 6	49 (43–56)	50	0	49 (40–57)[a]	23	0
Satisfied with knee specific working capability	Yes	56 (52–60)	136	0	73 (69–76)	103	4
	No	46 (38–54)	30	1	46 (35–57)[a]	17	2
Primary indication	Osteoarthritis	56 (52–59)	144	2	69 (65–73)	105	6
	Reumatoid arthritis	53 (26–79	3	0	45 (2–89)[a]	2	0
	Post-traumatic osteoarthritis	37 (13–60)	5	0	73 (48–98)	3	0
	Secundary osteoarthritis	35 (25–44)	4	0	65 (30–99)	3	0
	Osteoarthritis post osteotomy	54 (40–40)	11	0	76 (62–91)	8	1
Diabetes	No	55 (51–58)	155	2	71 (67–75)	112	7
	Yes	52 (42–63)	12	0	49 (37–62)[a]	9	0
Obese (BMI>30)	No	52 (47–56)	96	1	70 (65–75)	71	5
	Yes	58 (52–64)	68	1	69 (63–75)[a]	47	2
ASA	1 or 2	54 (50–57)	144	2	70 (66–74)	106	7
	3 or 4	60 (51–70)	20	0	63 (52–75)[a]	13	0
Smoker at operation	No	55 (51–59)	136	2	68 (64–72)	99	6
	Yes	51 (43–60)	31	0	74 (67–82)	22	1
Type of work 3 months before operation	Light work	57 (51–62)	66	1	70 (64–76)	53	2
	Medium work	57 (51–63)	44	0	72 (64–79)	25	0
	Heavy work	48 (39–57)	27	0	73 (65–80)	22	2

[a] Change that is not clinically relevant. A score that improved more than 13 points is seen as a clinically relevant change on the WORQ questionnaire.

clinically relevant improvement with respect to their total WORQ score (Table 2). This might suggest that other limiting factors play a more important role for these patients although the numbers reported here are small.

The patients who benefit most from TKA are those whose work involves operating a vehicle, like taxi or lorry drivers, or who have a job which requires periods of standing or walking on level ground, for instance working in a bar, as a postman or as a ware-house worker. For these activities, the ROM is less important whereas pain reduction is likely to play a more important role.

Of the study group 50 patients scored a 5 or lower on the WAI to describe their physical work ability, which can be considered an unsatisfactory result. There were no studies that looked at the WAI in patients with knee osteoarthritis or after TKA so it is hard to put this aspect in perspective. To the statement – I am satisfied with my ability to work with respect to my TKA – 30 (17%) patients stated they were (strongly) dissatisfied. It has been reported that 8% of patients are dissatisfied with the outcome at 2–17 years [10]. It seems that with respect to the ability to work, patients are far less satisfied with the result of TKA.

Limitations

The rating of the knee burdening activities section of the questionnaire we developed was new and although validated in our previous report not yet broadly used. As this is a novel field of research there are no other validated questionnaires that could be used. A second issue is the retrospective nature of reports by patients about their 'return to work'. Hence, there is a potential for recall bias in the results. This is why categories were made with respect to the time interval for return to work instead of an exact amount in weeks or months. It is assumed that patients are able to assess work specific tasks at three different and distinct time points. In future research, the questionnaire will be given to patients pre-operatively and at regular follow-up moments to generate more precise results.

Table 3
'Return to Work' Following Total Knee Arthroplasty (Primary, Revision or Uni-Knee Arthroplasties) According to Other Studies.

Author	Journal	Pubmed ID	Year	Age at Operation of Patients With TKA	Total Number of Patients With TKA	Patients Working Pre-Op	Number of Patients Returning to Work Post-Op (%)	Median of RTW in Weeks	RTW Assessed at
Clyde et al	J Arthroplasty	23583541	2013	55	98	98	64 (65)	15.5 (N=98, mean)	17–125 months
Husted et al	J Bone Joint Surg Br.	21357957	2011	68.3	421	82	46 (56)	–[a]	24 months
Styron et al	J Bone Joint Surg Am.	21209263	2011	57.0	162	162	122 (75)	8.9 (N=162)	3 months
Foote et al	Knee	19632120	2009	54.1	41	27	23 (85)	12 (N=27)	14–61 months
Lombardi et al	Clin Orthop Relat Res.	19225852	2009	62.0[a]	103[a]	–[a]	–[a]	8 (N=103)	2–52 months
Walton et al	J Knee Surg.	16642887	2006	71.5	120	21	17 (81%)	–[a]	
Jorn et al	Acta Orthop Scand.	10569263	1999	56.0	162	88	52 (59)	(54% within 26 weeks)	2 years post surgery
Nielsen et al	Ugeskr Laeger.	10434787	1999	–[a]	926	51	40 (78)	–[a]	1 year post surgery
Weingarten et al	Am J Med.	9688019	1998	69.7	287	50.56	41 (81)	–[a]	3–5 months
Summary / mean				Weighted mean 64.5	Total 2217	Total 580	Total 405 (70)	Weighted mean 10.5	
Present study			2013	60.1	480	173	121 (70)	50.4% within 12 weeks	24–86 months

[a] = not used for the column sum/mean in the summary/mean row.

Strengths

Our patient group is thought to be large and varied enough to give a representative picture of the impact of TKA in the Netherlands on 'return to work'. Patients came from two different areas in the Netherlands, which improves the external validity of the results. To ensure that the results are adequate and interpretable, the questionnaire was carefully developed and validated by a team that consisted of orthopedic and occupational health experts as well as the patient population itself. The WAI was introduced in 1997 [23,24] and has been proven reliable [26] and the single item has a moderate predictive validity for return to physically demanding work [27]. The purpose of the WORQ was to obtain an adequate range to discover which of work related activities remain difficult to perform and which benefit most from TKA. We believe it has proven adequate to answer our research questions.

Clinical and public health implications

It is increasingly important for society that people are able to work longer. Pension funds suffer because of lower contributions from a decreasing work force while the burden to pay out increases as a greater proportion of the population retire and pensioners live longer. It is known that the aspects of high motivation, being female and being self-employed accelerate early return to work while having less pain pre-operatively, having a physically demanding job and receiving sick pay are decelerators [13]. Further research should, however, not only focus on when patients 'return to work' but also on how well they are able to perform work. It will be useful to find out more about predictors for adequate 'return to work' and which limitations patients perceive in their work with respect to their knee function. Multidisciplinary interventions, such as guidance by an occupational health physician or advice to tailor work activities temporarily, can then be evaluated to ensure speedier *and* more sustainable return to work for a group of patients that is likely to increase substantially in the upcoming decades. By improving TKA outcome with respect to the ability to work, patients can expect more fulfilment and a better quality of life. This will potentially benefit not only patients of working age but also employers and, ultimately, society as a whole by reducing costs related to sick leave, early retirement and diminished productivity. Thereby, the cost-effectiveness of TKA surgery is likely to increase substantially from society's perspective.

Conclusion

TKA reduces pain and improves function but has a less positive impact on return to work than we expected: in fact one third of patients do not return to work. TKA significantly, but unequally, reduces difficulties in carrying out knee-burdensome work activities and a considerable percentage of patients reported impaired ability to work and that they were dissatisfied with their level of ability to perform work. A holistic approach to TKA that includes adequate work-related support and a flexible attitude to tailoring work interventions to what is feasible for a specific TKA patients will be vital to ensure a timely and sustainable 'return to work' in a patient group that is likely to increase substantially in the coming decades.

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